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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/074,888	02/13/2002	Benjamin C.E. Schwarz	5298-06900 PM01027	6502

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EXAMINER	
DEO, DUY VU NGUYEN	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 01/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/074,888	SCHWARZ ET AL.	
	Examiner	Art Unit	
	DuyVu n. Deo	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 December 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11,13-15,17,18 and 28-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11, 13-15, 17, 18, 28-30, 32-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-11, 13-15, 17, 18, 28-30, 32, 33, 35, 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Keil (US 6,630,407) and Khajehnouri et al. (US 6,117,786).

Keil describes an etching method comprising: etching a stack of layers within a single etch chamber (col. 2, line 18-30, 44-45), the layers comprises an organic ARC layer, a nitride layer arranged beneath and in contact with the ARC layer, and underlying layer beneath the nitride layer. Argon is introduced during etching of the ARC (col. 2, line 39, 40). This would read on claimed a noble gas heavier than helium is introduced into the chamber during the etching.

Unlike claimed invention, Keil doesn't describe the noble gas for etching of each layer is different from each other, using noble gas during etching (also referring to claims 2, 3, 11, 12, 14, 17, 18, 31, 33, 37) is well known to one skilled in the art as shown here by Khajehnouri. He teaches of using noble gases including ones that heavier than He such as Ar, Ne, Kr, Xe as carrier gases during the etching process (col. 2, line 18-20). Even though applied prior art doesn't suggest at least one of the first, second and third noble gases differs from the remaining

noble gases; however, in the absent of unexpected result, using any of those noble gases for each step would be obvious with a reasonable expectation of success.

Unlike claimed invention, Keil doesn't describe etching layers in the stack with a different etch chemistry than used for etching other layers in the stack, or the etching the underlying layer with an etch chemistry different that that of the first and second chemistries. However, he suggests to etch the ARC selectively to other layers and the ARC etch chemistry is tailored so that it would etch the ARC selectively to the under layer including the nitride layer (col. 2, line 5-10). It would have been obvious to one skilled in the art to etch the layers in the stack with etch chemistry that is tailored for each layer in order to provide a selectively etching for each layer. This would provide claimed etching one or more layers in the stack with a different etch chemistry than used for etching other layers in the stack.

Referring to claims 7, 8, the underlying layer can comprise polycrystalline silicon (col. 5, line 14).

The etching chamber used for the test is an oxide etch system (col. 4, line 26-28). The oxide would be silicon oxide. Therefore, the chamber would also have to be configured for etching material comprising silicon. This would read on claimed the etch chamber is configured for etching a material comprising silicon.

Referring to claims, 9 and 10, at the time of the invention, it would have been obvious to one skilled in the art that the underlying can be monocrystalline silicon or silicon-germanium depending on the device being manufacturing since Keil suggests that the underlying layers can be semiconductor layer (col. 5, line 14).

Referring to claim 11, the etching reactor includes inductively coupled plasma reactor (col. 2, line 23), which is also a low-density plasma etch chamber (please see cited art below).

Referring to claim 30, since the nitride layer is exposed as the ARC is being etched away, some of the nitride layer (claimed a portion of the nitride layer) would also be etched away.

Referring to claim 28, Keil suggests the Ar flow rate is 50-500 sccm (col. 8, line 46) and he teaches that the gas flow rate depends on the size of the substrate, type of plasma reactor, power settings, etc. (col. 8, line 65-col. 9, line 3); therefore, it would have been obvious to determine the Ar flow rate through routine experimentation depending on the above parameters in order to provide optimum Ar flow rate with a reasonable expectation of success.

Referring to claim 35, the underlying layer can comprise metals, which would form claimed interconnect line and they have dimension within a CD specification (col. 1, line 60-65; col. 5, line 5-17).

Referring to claim 15, Keil further shows a pattern photoresist layer arranged over the ARC before etching the ARC and removing the remaining of the photoresist and the ARC layers subsequent to etching the cap nitride layer (col. 5, line 42-53).

Referring to claim 37, whatever the noble gases being used, they must be different from the remaining noble gases.

3. Claims 34 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Keil and Khajehnouri as applied to claim 32 above, and further in view of Lim et al. (US 6,403,484).

Referring to claims 34, since Keil suggests the underlying layer can be different kind of layers including semiconductor layers and this would form different type of device including

claimed forming dielectric material in the opening of the underlying layer to form isolation structure. This process of forming isolation structure is well known to one skilled in the art at the time of the invention as shown here by Lim (col. 3, line 4-14), who also shows forming the nitride by thermal growing is a process practiced by one skilled in the art at the time of the invention (col. 3, line 38-40). Therefore, it would have been obvious to one skilled in the art that an isolation structure can be formed in light of Keil and Lim with a reasonable expectation of success.

4. Hung et al. shows prior art (col. 3, line 35; col. 4, line 31-33).

Response to Arguments

5. Applicant's arguments, see remark, filed 12/19/05, with respect to the rejection(s) of claim(s) 1, 4-8 under 102(e) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Keil and Khajehnouri.

Applicant's argument that Keil doesn't explicitly teaching of etching the layers in the stack with a different etch chemistry for each layer in the stack is acknowledge. However, he describes etching the ARC layer in the stack selectively to above and under layers (col. 3, line 25-32) and he teaches that the selective etching is to minimize attacking of the under layers and to improve the uniformity, CD, and profile of the openings (col. 4, line 1-18), therefore, one skilled in the art would find it obvious to etch other layers selectively, which would have to require different etching chemistry for each layers, in order to provide improvement in uniformity, profile, and CD of the openings.

Referring to applicant's argument that a chemistry that is more selective to layer A than layer B can still be used to etch both layers is acknowledged; however, it would not be obvious and desired by one skilled in the art to do so, especially in light of Keil's teaching of etching the ARC layer in the stack selectively to above and under layers (col. 3, line 25-32) and he teaches that the selective etching is to minimize attacking of the under layers and to improve the uniformity, CD, and profile of the openings (col. 4, line 1-18). It would not be desired to etch the bottom layer with the chemistry that is tailored to etch the top layer because top layer would be etched again, which would change the CD and profile of the openings.

Applicant's argument that Keil suggests using the same chemistry for etching the ARC and the under layer as shown in col. 4, line 15-25 is found unpersuasive because he only describes the affective of the CO on the underlying dielectric layer, but not a step of etching the underlying dielectric layer.

The etching chamber used for the test is an oxide etch system (col. 4, line 26-28). The oxide would be silicon oxide, a material comprising silicon. Therefore, the chamber would also have to be configured for etching material comprising silicon. This would read on claimed the etch chamber is configured for etching a material comprising silicon. Also, please see Hung et al. shows prior art (col. 3, line 35; col. 4, line 31-33). Applicant's argument that Hung indicates that an inductively coupled plasma reactor is a high-density plasma etch chamber is acknowledged. However, Hung also indicates that the inductively coupled plasma reactor is also a low-density plasma etch chamber (col. 3, line 35; col. 4, line 31-33).

Applicant's argument that Keil doesn't describe the first and second different noble gases are different from one another is acknowledged. In response to applicant's arguments against the

references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Since the uses of those noble gases that are heavier than the He are known to one skilled in the art as carrier gases, as described above by Khajehnouri, in the absent of unexpected result, using any of those carrier gases wherein each step uses a different carrier would be obvious to one skilled in the art at the time of the invention with a reasonable expectation of success.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-2:30 Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Primary Examiner
Duy-Vu N. Deo
12/29/05

DJ